REMARKS

This response is accompanied with a request for a two-month extension of time along with the required fees. Claims 1, 5, and 21 are being amended in this response. No claims are being added in this response.

Summary of Substance of Interview

During the Examiner interview of September 19th, 2007, the Applicant Gopal Ramachandran, Mr. Vakili and the Examiner discussed proposed claim amendments, and whether the proposed amendments were obvious in light of Lin (US 2002/0075459), Raskar (US 6,520,647), and Tejima (US 5,274,406). The Examiner suggested that a declaration be filed to show evidence that the claims are not obvious over the combination of the cited references.

Claim Objections

Items 4 and 5

On page 3 item 4 of the Office Action the Examiner argued that claims 4, 5, and 17 are objected to because of the following informalities: claim 1 upon which claims 4, 5 and 17 are dependent no longer includes the limitation "at least one curved mirror."

In response, the Applicant appreciates the Examiner's guidance and submits that unfortunately the phrase "said optical reflection assembly comprising at least one curved mirror" was inadvertently removed from the previous response due to a clerical error. The Applicant has therefore presently added the above phrase to the presently amended Claim 1 of the Subject Application which now reads:

"1. An off-axis projection system for displaying an image on a display surface based on input image data, comprising:

an image processing unit for receiving the input image data representing a two-dimensional array of pixels, and electronically warping the input image data, prior to projection, to generate two-dimensional electronically warped image data;

a projection light engine having a display device with means to modulate a two-dimensional array of pixels, said light engine being coupled to the image processing unit and adapted for receiving the electronically warped image data, modulating a two-dimensional warped image corresponding to the electronically warped image data on the display device, and projecting the two-dimensional warped image to create a projected image; and,

an optical reflection assembly coupled to the projection light engine adapted to direct the projected image onto the display surface, said optical reflection assembly comprising at least one curved mirror,

wherein, the electronic warping is performed such that in the projected image on the display surface, optical and geometric distortions, including distortions caused in the light engine and the optical reflection assembly, are substantially eliminated."

The Applicant has in addition amended Claim 5 of the Subject Application such that it now depends on Claim 43. The Applicant has also amended Claim 21 of the Subject Application to replace "tow-dimensional" with "two-dimensional" on lines 5 and 6.

Claim Rejections – 35 USC § 103

Items 8 and 13

On pages 4 and 12, Items 8 and 13, of the OA, the Examiner argued that Claims 1 and 21 are rejected under 35 U.S.C 103(a) as being unpatentable over Lin (US 2002/0075459) in view of Raskar (US 6,520,647) and Tejima (US 5,274,406).

According to the guidelines set in the interview of September 19, 2007, the Applicant has presently amended Claims 1 and 21 as described above. In addition the Applicant has prepared a declaration by the inventor which is attached.

The Applicant respectfully submits that no combination of Lin and Raskar could arrive at the presently amended Claim 1 of the Subject Application as explained below. Neither Lin, nor Raskar, nor Tejima, nor any combination thereof, addresses electronic warping for distortion correction in the presence of a curved mirror. No combination of Lin, Raskar, or Tejima could have been envisioned by a person of ordinary skill in the art, at the time of filing of the Subject Application, to achieve a commercially desirable RPTV with a diagonal-to-depth (D-to-d) ratio that can be achieved according to the subject matter in the presently amended Claims 1 and 21 of the Subject Application. The following arguments are presented to further illustrate these points.

It is respectfully submitted that Lin teaches mechanical adjustment of a projector via a positioning bracket until the reflection of the image off a seemingly flat mirror is sharp (Lin Paragraph 13 and Figures 1 and 2). Lin's projection system is a simple on-axis projection system in a box which uses "a lid for dust protection and esthetic appearance" (Lin Paragraph 14). There is no optimization of the D-to-d ratio in Lin. As such, Lin's system projects an image which does not seem to suffer any distortion (or Lin does not mind any distortion or correction thereof) and even the projector could be taken out of the housing and used in a totally different mode (Lin Paragraph 14). The sole purpose of Lin's electronics is to accept pushbutton commands from the front console and change the inclination of the cradle holding the projector and/or the inclinations of the mirrors.

Raskar, on the other hand, teaches a method for automatically correcting keystone distortion or rotational errors in a front projection system by using a camera along with tilt and

rotation sensors such as lasers, magnetic sensors or gyros (Raskar Column 2 lines 48-65). As such, Raskar's teachings are related to purely geometric distortion related to the relative position and orientation of a projector and the projection screen. Raskar does not even address spherical distortions due to curved mirrors and/or rotationally asymmetric lenses. Raskar therefore does not teach or suggest correction for distortions caused by a lens system or an optical reflection assembly with a curved mirror.

Tejima shows that curved mirrors may be used to minimize the keystone distortion due to off-axis projection. However, the curvature degrades the image because actual, physically realizable lenses introduce aberrations. Specifically, Tejima Column 7, Lines 38-43 states that "a curved surface in the reflecting mirror degrades the image and therefore a Fresnel form of mirror implementation is required in order to keep the mirror surface planar". In addition in Column 3, Lines 13-17, Tejima states that "For reference, design values and performance, when a so-called ideal lens, which does not cause aberration is employed are given below"). These statements, along with others (for example see Column 3, lines 19-20, where Tejima uses an ideal lens of zero thickness for his calculations, or Column 3, lines 33-36 in which Tejima states that "As an ideal lens is employed, the spots converge completely on a single point of the screen....etc"), are indications of anomalies, artifacts and distortions caused in an image by the reflection from a curved surface and the passage of light through real lens assemblies. These artifacts cannot be brushed off or ignored, and it is submitted that they must be corrected somehow for a product to be commercially viable.

Tejima acknowledges the difficulties of making thin-housing RPTVs using off-axis projection. For example, in Column 4, lines 29-35, Tejima states that "Although the mechanical configuration can be made thinner if the angle between the screen 40 and the reflecting surface

30 is made smaller, the image distortion as projected on the screen 40 will be large as shown in Fig 7B with the result that the system cannot withstand practical use". Also, in lines 36-41 following this paragraph Tejima further elaborates on the degradation in performance due to defocusing and image distortion caused by the off-axis projection geometry and use of a curved mirror. Tejima proposes a solution to this problem by replacing the curved mirror with a flat mirror cut with a series of horizontal and vertical grooves enclosing small plane mirror segments, i.e. a Fresnel mirror (Tejima Fig 16A). Tejima discloses that this improves the distortion (Column 10, lines 55-56) but Tejima's Fig 13D still shows visible distortion and even with the use of an ideal lens, Tejima's distortion plots would not be acceptable by today's consumers.

The Applicant submits these shortcomings in the prior art can be solved by the subject matter of amended Claims 1 and 21 of the Subject Application and definitely not by any combination of Lin, Raskar and Tejima. In other words, the distortions introduced by conventional curved mirrors and real lenses can be greatly eliminated (such that the residual distortion is less than is present even with a conventional on-axis projection system) while at the same time enabling D-to-d ratios of 6 or greater.

To see what kind of housing depth reductions Tejima achieves, Column 2, lines 49-56 in Tejima shows that Tejima uses a magnification of 12x (modern RPTVs need to magnify >100x) producing an image of dimensions 8x91.44mm by 6x91.44mm or 732x549, which has a diagonal of 914.4mm. Tejima's best thickness is given in Column 8, line 51 as 278.27mm, giving a D-to-d ratio of 3.29.

The Applicant therefore submits that the inventiveness of the Subject Application, as set forth in presently amended Claims 1 and 21, is in using, inter alia, a light engine and a curved mirror in conjunction with electronic warping for distortion correction. Such electronic distortion

correction includes correcting for the image distortions and anomalies caused in the light engine and the reflection assembly themselves as set forth by the presently amended Claims 1 and 21 of the Subject Application. This is clearly stated in presently amended Claims 1 and 21 of the Subject Application where it reads: "wherein, the electronic warping is performed such that in the projected image on the display surface, optical and geometric distortions, including distortions caused in the light engine and the optical reflection assembly, are substantially eliminated."

The Applicant further submits that the subject matter of the presently amended Claims 1 and 21 of the Subject Application, achieves a commercially desirable RPTV solution that would not have been inferred from any combination of Lin, Raskar, and Tejima by a person of ordinary skill in the art at the time the filing of the Subject Application. The subject matter of the presently amended Claims 1 and 21 of the Subject Application presents a unique combination of elements, including inter alia, a light engine, a reflection assembly with at least one curved mirror, and electronic warping for image distortion correction, including image distortions caused in the light engine and the reflection assembly, all of these elements being necessary to achieve a commercially viable RPTV with desirable D-to-d ratio according to the teachings of the Subject Application.

A person of ordinary skill in the art trying to arrive at the subject matter of the subject application would encounter many impossible hurdles if he or she was to use a combination of Lin, Raskar, and Tejima. Such a person would have to look into the device of Lin, and think of using the mirror used in Tejima instead to achieve an off axis structure. According to the teachings of Tejima discussed above, he or she would then have to use a Fresnel surface for the mirror to avoid distortions. At this point he or she would have deviated from the subject matter

of the Subject Application considerably. In addition, he or she would not know what real world lens system to use since Tejima only assumes an "ideal" lens in his device. He or she would therefore arrive at a non-resolvable issue in addition to deviating from the subject matter of the Subject Application. This person would then have to turn to Raskar to correct for the unusual shape of the image on the screen. He or she would only be able to partially correct for the underlying distortions. Raskar's corrections would be far less than sufficient to create even a reasonable image, let alone a commercially acceptable image. The distortions suffered by an image going through a lens system and a reflection assembly having a curved mirror are far more complicated than the keystone distortions taught by Raskar. It is quite clear from the above scenario that such a person, in addition to advanced skills in the art, would need considerable inventiveness and intellect, and possession of novel electronic warp correction systems to even perceive of the subject matter of the subject application as set forth in presently amended Claims 1 and 21 of the Subject Application.

The Applicant therefore submits that the subject matter of the Subject Application, as set forth by presently amended independent Claims 1 and 21 of the Subject Application, is truly novel and patentable. The Examiner's reconsideration is therefore respectfully requested.

Items 8-16

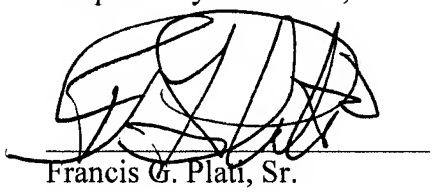
As to claims 2-20 22-38, 44, and 43, the Applicant has carefully considered the Examiner's comments. However, in the light of the above arguments, the Applicant submits that, for at least the reason that these dependent claims depend directly or indirectly on the presently amended Claims 1 and 21, they should be considered allowable.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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